Additions to the Catalogue of STARS which have changed their colors.*

BY JACOB ENNIS.

17. Spica. This star was described by Humboldt in 1850, as being "decidedly white." Cosmos, vol. iii. p. 181, Donati also arranges Spica among the white stars. It is now conspicuously blue, and has been observed of this color by myself and several friends since early in March. Inadvertently, in my communication of March in these Proceedings, I mentioned this star as Beta Libræ, which is in the near vicinity, but without speaking of a change of color.

18. Altair. Humboldt, in 1850, classes this star along with three others which he says "have a more or less decidedly yellow light." Donati also arranges it among the yellow stars. Altair is now, June, 1863, plainly blue.

19. Deneb, or Alpha Cygni. "Decidedly white," are the words employed by Humboldt to register this star in 1850. At present it is decidedly blue, and it has been of this color since early in May.

Vega. This star is placed in No. 9 of this Catalogue. Humboldt, in 1850, described it as bluish; Donati, in 1860, as white, on the authority of Schmidt. During February and March of this year, I often compared Vega and Capella together when they were at the same altitude in the Northern sky, and they seemed of the same tint, "a delicate pale blue." An observer in this city, in the middle of May, was very decided in saying to me that Vega was much bluer than Capella. On a reobservation of Vega, and from my recollection of Capella, I assented to this opinion freely. This star, I believed, had deepened its blue. Immediately there recurred to my mind the sentence of Kearny, about Capella, in a letter to Herschell, in 1859: "By the way, the color of Capella seems less blue than it used to be." Thus both these stars had changed their blue, though in opposite directions. On the 8th or 9th of June, I requested a friend who is not at all a star observer, to tell me of what color he regarded that star, pointing to Vega. After looking carefully a sufficient time he said it was green. I again looked myself, and was surprised to see that it appeared really green. Every night since then I have anxiously watched its appearance, and in very clear nights it seems green, but when the air is vapoury or hazy, it seems blue. I have referred it to some half a dozen individuals, and they, when the nights have been clear, have also pronounced it of a green color. Last winter, in clear moonlight nights, I ofted remarked that the green color of Sirius was obscured by the intermingling rays of the moon, reflected from the atmosphere. Now also Vega scarcely appears green by moonlight. There is reason to think that this change in the color of stars from blue to green is not uncommon. Humboldt says, "when forced to compare together the colors of double stars, as reported by several astronomers, it is particularly striking to observe how frequently the companion of a red or orange-colored star is reported by some observers as blue, and by others as green." Cosmos, vol. iii. p. 284, note.

Donati, in the memoir referred to in my communication of March, gives Humboldt in Cosmos, and Schmidt in Ast. Nach., as the authorities for his classification of the colors of the stars. Therefore I was misled in the dates for the color of his stars, for they cannot be as late as that of his memoir. Hence, also, the supposed discrepancy between him and Kearny disappears. Moreover, whenever he departs from the earlier of his authorities, Humboldt in 1850, I suppose it must be in favor of the latter, Schmidt. If this supposition be correct, then it would indicate that between the observations of Humboldt, and those of Schmidt, several changes of color among the stars had occurred. Humboldt gives Procyon as a yellow star, Donati as white. Humboldt

*See pages 26 and 96 of this volume.

speaks of Castor as greenish, Donati as yellow. I have not access just now to the volumes of the Ast. Nach. containing Schmidt's observations.

STARS OF THE FIRST MAGNITUDE.

Of the seventeen first magnitude stars, the changes of the colors when tabulated, stand as follows; the changes having been in the order they are here placed, the last named being their present colors. The numerals refer to the authorities below:

1. *Visible in this latitude, the 40th degree, whose colors have changed.*

Sirius: red,[1] white,[4, 6] violet-blue,[7] green.[7, 8]
Capella: red,[1, 2, 3] yellow, [4, 6] deep blue,[5] pale blue.[5, 8]
Vega: bluish,[4] white,[6] pale blue,[8] deep blue,[8] green.[8]
Procyon: yellow,[4] white,[6] blue.[8]
Altair: yellow,[4, 6] blue.[8]
Rigel: white,[6] blue.[8]
Spica: white,[4, 6] blue.[8]

2. *Visible in this latitude whose colors have not been known to change.*

Aldebaran: red.
Betelgeuze: red.
Antares: red.
Arcturus: orange yellow.

} All these along with Sirius and Pollux were denominated fiery red by the ancients.

3. *Invisible in this latitude whose colors have changed,*

Alpha Crucis: growing red.[9]
Eta Argus: orange yellow,[11] deep red.[10]

4. *Invisible in this latitude.*

Canopus.?
Alpha Eridani.?
Beta Centauri.?
Alpha Centauri. This is a double star, about the colors of the two companions Sir John Herschell says, "Both of a light ruddy or orange color, though that of the smaller is of a somewhat more sombre and brownish cast.

Authorities. — 1. The ancients; Seneca, Ptolemy, &c. 2. El Fergani. 3. Riccioli. 4. Humboldt. 5. Kearny. 6. Donati, quoting Schmidt. 7. Wilcocks. 8. Ennis. 9. Berard. 10 Gilliss. 11. Mackay. Besides these authorities for first magnitude stars, there are the elder Herschell and Struve for double stars not yet added to this catalogue, the younger Herschell and Abbott for the six stars in Kappa Crucis, Heis for Beta Ursæ Minoris, and Tycho Brahe for the star of 1575; for the green of Castor Mr. Humboldt quotes Mädler in 1849, and Miss Maria Michell describes the same star as yellow in 1863: making in all nineteen authorities, and of a character that cannot be doubted.

Among the eleven stars of the first magnitude visible in this latitude, seven, according to these evidences, have undergone changes of color, and some of them more changes than one. Among the six stars of the first magnitude in the southern hemisphere, not visible here, two have changed their colors, and of the remainder I can say nothing. And nearly all these changes have been sudden, transpiring in short periods. Moreover, none of the eleven first magnitude stars visible here are white,—all are either red, yellow, green, or blue. I look with a great deal of surprise on this tabular statement. Why has it not been made long ago? Probably, in great part, because changes in the colors of stars could not be accounted for by any prevailing scientific theory. It has been rationally assumed that the stars are similar in constitution to the sun, and the sun has been encircled with a theory which affords not the least

[June,

clue to any changes of color. This theory is most singularly complicated and unfortunate. It surrounds the sun, said to be dark, with an apparatus consisting of five distinct atmospheric envelopes, all regularly arranged one above the other: first, a transparent envelope touching the opaque body of the sun; secondly, a fiery luminous envelope; thirdly, another transparent envelope; fourthly, another fiery luminous envelope; fifthly, a transparent envelope surrounding all the others. Among such a number of imaginary things, there seems to be no room to imagine how changes of color could occur. Hence the mention of a change of color in a star has been regarded as anomalous, as an inconvenient fact, having no relation to any popular theories, and no appropriate place in the ordinary systems. Hence observations on the colors, and on the changes of colors, have not been stimulated, but rather repressed by this complex theory of the sun.

Another cause for the delay in this department of Astronomy, is the difficulty of deciding on the real colors of the stars. The reason why I did not myself first notice the greenness of Vega, was because I had been accustomed to regard it as blue. I relied unknowingly more on my belief than on my vision. This is the same as when in twilight, or less often in broad day, we think we see an object very distinctly, and on a more careful view it turns out to be really something totally different in all its parts. We see partly with our judgment, and partly with our eyes, and it often happens that our judgments warp and change the impressions on the eye. The discoverer of the change of Sirius from its former white, had been so long accustomed to regard that star as of a purple or violet blue, that it was some time after I had said it was green, before he convinced himself of its green color. Then as we all had the vague idea, though entirely baseless, that a great star millions of miles in circumference could not change so soon, he thought he must have been mistaken about the violet color. And so did I; but since my recent observations of Vega, I do not think so. Sirius and Vega seem both alike to have changed quite recently and suddenly from blue to green. Hundreds of observers had seen Sirius through a telescope, and yet Clark, of Boston, was the first to notice that it had a companion, although that companion had been plainly enough in the field of view of all their telescopes. Since then, Goldschmidt, of Paris, has announced, that with a far inferior instrument, he has observed five more companions of Sirius, all shining in its near vicinity. Previous observers did not see them, although they must have received the impressions on their retinas. Direct attention was required to those special objects. In a clear night we seem to see, by an optical illusion, ten thousand stars. The whole heavens swarm with them, and all, on account of their minuteness, appear to the naked eye to shine with a white light. The milky way deepens this general impression of whiteness. Probably less than fifty stars on any night, at once, are large enough to give the impression of colors to the naked eye. Thus the great mass appearing white, we assume that all are white, and by this means, the judgment being wrong, the colors strike the retina, but are not noticed.

While the telescope is necessary to distinguish the colors of the smaller stars, I have a suspicion that the naked eye is best for stars of the first magnitude, and perhaps for the second. These can be seen sufficiently well by the unaided eye, and no delicate tints are absorbed or added, as may possibly be done by the glasses and specula of instruments. The disturbing effects of the atmosphere, of moonlight, and of artificial lights, may be avoided by repeating the observations at different times.

In connection with the fact that all the stars of the first magnitude visible in this latitude, and at least 3 of the 6 not here visible, are colored, it may be well to state my opinion, that colored stars of all magnitudes, are far more numerous than they are generally supposed, even by Astronomers. Of 600 of the brighter double stars in the great catalogue of Struve, published in 1837, more

than one half are reported as colored, either in one or in both the companions. A catalogue of 36 stars are reported in the forthcoming number of the *American Journal of Science and Art*, for July, by MARIA MITCHELL, and selected for the measurements of distances and angles of position; 30 of these are colored in both the companions, 5 were observed in weather unfavorable for observations of color, and of the remaining one nothing is said. There is a rich mine of information in observations on the colors and on the changes of colors in the stars.

Descriptive Enumeration of a collection of FISHES from the Western Coast of Central America, Presented to the Smithsonian Institution, by Capt. John M. Dow.

BY THEODORE GILL.

Captain John M. Dow having recently forwarded a small collection of Fishes and other animals to the Smithsonian Institution, attention was arrested by the interesting nature of some of the species, and it has been deemed advisable to publish descriptions of them as well as all the other new species. Only five had been previously described; twenty-two of them are new and several represent new generic types. Many of the species are closely related to West Indian species.

Family *GERROIDÆ* Bleeker.

Genus DIAPTERUS Ranz., Gill.

Eucinostomus *Baird* and *Girard*.

DIAPTERUS DOWII Gill.

The greatest height is contained $3\frac{1}{3}$ times in the extreme length; the head $4\frac{1}{4}$ times; the diameter of the eye $2\frac{3}{4}$ in the head; the snout equals 4-5ths of the eye. The profile is rectilinear and the interorbital space nearly flat, but convex above the eyes, and nearly as wide as the eye. The maxillary groove is linear and extends backwards to a vertical midways between the front of the orbit and pupil, while the scales on each side extends to the vertical from the front of the orbits. The exposed surface of the supramaxillary bones is at first triangular and thence oblong, the whole $2\frac{1}{2}$ times as long as wide.

The height of the constricted portion of the caudal peduncle equals two-thirds of its length and the diameter of the eye. The lateral line is scarcely bent behind. The second and third dorsal spines are slender, and nearly equal half the height of the body beneath; the last is little more than half as long as the first branched ray. The third anal spine is as long as the snout and longer, but more slender, than the second.

D. IX. 10. A. III. 7. C. 4. I. 8. 7. I. 3. P. 1. 14.

Scales $47\frac{5}{10}$—

The color is silvery; the spinous dorsal blackish at margin; the axilla of pectoral blackish.

Three specimens were obtained along the coast. I dedicate the species to the excellent collector, Capt. Dow.

Family *CHÆTODONTOIDÆ* (Cuv.)

Genus POMACANTHODES Gill.

POMACANTHODES ZONIPECTUS Gill. Proc. Ac. Nat. Sci. Pa., 1862, p. 244.

A single specimen in the collection, between three and four inches long, ex-